

# VULNERABILITY REDUCTION SOLUTIONS

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## REINFORCED CONCRETE BUILDINGS

### GENERAL INFORMATION

**Strengthening Intervention:**

**Reinforced Concrete Buttress**

**Applicable Building Types:**

1. Main structural system:.....	RC1 <input checked="" type="checkbox"/>	RC2 <input checked="" type="checkbox"/>	RC3 <input checked="" type="checkbox"/>	RC4 <input type="checkbox"/>	RC5 <input type="checkbox"/>
2. Height range:.....		Low (LR) <input type="checkbox"/>	Medium (MR) <input checked="" type="checkbox"/>	High (HR) <input checked="" type="checkbox"/>	
3. Seismic design level:.....	Poor (PD) <input checked="" type="checkbox"/>	Low (LD) <input checked="" type="checkbox"/>	Medium (MD) <input type="checkbox"/>	High (HD) <input type="checkbox"/>	

### EXISTING STRUCTURAL DEFICIENCIES

-Excessive building flexibility; -Soft story; -Captive column; -Low horizontal capacity and resistance.

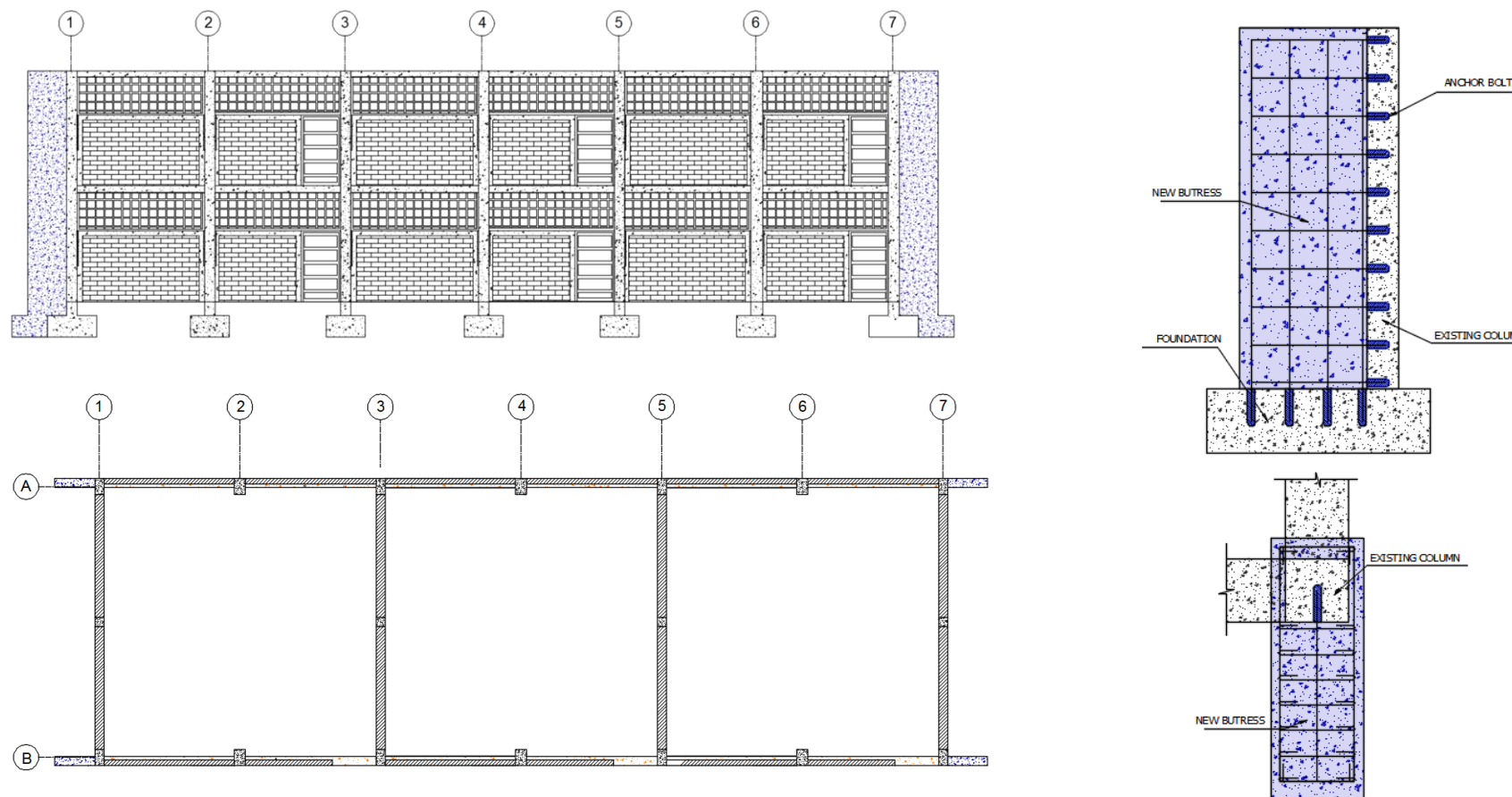
### STRUCTURAL IMPROVEMENTS AFTER STRENGTHENING

- Stiffness increase.
- Ductility increase.
- Fragile collapse mechanism avoided.

### STRENGTHENING INTERVENTION DESCRIPTION

The proposed strengthening intervention provides stiffness to the building and eliminate the short column (or weak story) collapse mechanism. In first place it is necessary to select at least two end columns in the longitudinal direction, to reinforce the building. Build foundation for each buttress. Construction and installation of internal steel reinforcement with proper anchorage system to existing column. Pour the concrete to conform the buttress. Last step is to isolate and retrofit non-structural masonry walls in remaining bays.

### ILLUSTRATIVE FIGURES



### FURTHER REFERENCES

- ASCE (2017). Seismic Evaluation and Retrofit of Existing Buildings ASCE 41-17. American Society of Civil Engineers, Washington DC, USA.
- FEMA (2012). Reducing the Risk of Nonstructural Earthquake Damage - A Practical Guide FEMA E-74. Federal Emergency Management Agency, Reston, Virginia, USA.

### Notes:

- The proposed intervention options are for illustration purposes only.
- All dimensions, details and material specification has to be specifically designed for each application case.
- Any actual reinforcement solution requires the participation of a structural engineer.
- The authors do not assume any responsibility for the use of the proposed reinforcement options.